SCHEMA THEORY AND LANGUAGE COMPREHENSION

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Comprehending a text is not simply a function of the text itself--the text alone does not carry the meaning to be conveyed.[1] The listeners or readers of a text make a significant contribution to the meaning conveyed. A text provides directions for listeners/readers as to how they should retrieve or construct the intended meaning from their own, previously acquired knowledge. Comprehension is the interactive process between the listener/reader's background knowledge and the text. Recent research in discourse comprehension has shown that background or schematic knowledge plays an essential role in the psychological processes by which listeners or readers comprehend. This paper reviews the most important work on the role of schemata in language comprehension, including both theoretical and empirical research. The latter includes first language research among fully proficient adult native speakers of English and among children in the process of acquiring English as their native language, as well as cross-cultural research and second language research.

Background Knowledge

Background knowledge refers to a set of closely related concepts which have recently been seen as useful in

describing language comprehension. These concepts, emanating from basic research at the intersection of artificial intelligence, cognitive psychology and linguistics, in what is called the new discipline of cognitive science, are referred to variously in the literature as schemata,[2] scripts,[3] frames,[4] event chains,[5] and expectations.[6] These terms, which are referred to broadly as schema-theoretical orientations, are not all identical. They have important differences. Yet, they share some fundamental assumptions and yield some of the same important insights into language comprehension.

The idea of a schema was suggested as early as 1781 by Kant in his work The Critique of Pure Reason.[7] He proposed that concepts could have meaning only when they were related to something the individual already knew. That is, the individual possesses general concepts to which he relates more specific concepts. Bartlett, in his 1932 book, Remembering, described a schema as "an organization of past reactions, or of past experiences" which is constantly functioning.[8] When new experiences are encountered, they are understood only as they can be related to an existing schema and simultaneously become a part of it.

More recently, schemata have been called "interacting knowledge structures."[9] These interacting knowledge structures are hierarchically related to one another, from most general at the top of the hierarchy to most specific at the bottom. To illustrate what is meant by a schema, consider Schank & Abelson's famous example of the "going to a restaurant" schema.[10] In this general schema there are certain components of the meaning sufficiently general to capture the essential aspects of all members of the class--i.e., such general information as that a restaurant is a commercial establishment where people pay money to have someone else prepare their food and clean up after them. Included in this general schema are event-sequential variables like entering the restaurant, being seated, being given a menu, ordering, eating, paying, and leaving. Moving down the restaurant hierarchy are more specific schemata, such as one for sit-down restaurants, another for ethnic restaurants, dinner-theaters, and so on. Further down the hierarchy of ethnic restaurants, for example, one might find Italian, Greek, Chinese, Mexican restaurant schemata. At the bottom of the hierarchy for Mexican restaurants, would be separate schemata for each known Mexican restaurant. In general, as one moves down the hierarchy, the number of embedded schemata multiplies, while the scope of each narrows, until

at the bottom are unique perceptual events. As new experiences are gained in "going to a restaurant," these new experiences are embedded into the existing hierarchy at all appropriate levels of generalization.

The process of interpretation, according to schema-theory, is guided by the principle that every input is mapped against some schema and that all aspects of that schema must be compatible with the input information. This principle results in two basic modes of information processing, called bottom-up and top-down processing. Bottom-up processing is evoked by the incoming data; the features of the data enter the system through the best fitting, bottom level schemata. As these schemata converge into higher level schemata, these too are activated. Bottom-up processing is data-driven. Top-down processing occurs as the system searches the input for information to fit into partially satisfied, higher order schemata. Top-down processing is conceptually-driven.

Schemata are claimed to guide the comprehension not only of events and scenes, but also of the linguistic representations of events and scenes, i.e., or oral and written texts, and of the hierarchical rhetorical organization of these texts. The former are sometimes called content schemata and the latter are called formal schemata.

An important aspect of schema-theoretic accounts of language comprehension is that top-down and bottom-up processing should be occurring at all levels of analysis simultaneously.[11] The data that are needed to instantiate or fill out the schemata become available through bottom-up processing; top-down processing facilitates their assimilation if they are anticipated or consistent with the listener/reader's conceptual set. Bottom-up processing insures that the listener/reader will be sensitive to information that is novel or that does not fit her or his ongoing hypothesis about the content or structure of the text; top-down processes help the listener/reader to resolve ambiguities, or to select between alternative possible interpretations of the incoming data. Thus, a fundamental assumption of the schema-theoretic view of language comprehension is that the process of comprehending a text is an interactive one between the listener/reader's background knowledge of content and structure, and the text itself. The text alone does not carry meaning. Rather a text only provides guidance for listeners/readers as to how they should construct the intended meaning from their own background knowledge. Since comprehension involves not only the information in the text, but also knowledge the reader already possesses, efficient comprehension requires the ability to relate the textual material to one's own

knowledge.[12] Comprehending words, sentences, and discourse, then involves much more than just relying on one's linguistic competence. "Every act of comprehension involves one's knowledge of the world as well."[13]

First Language Research

Adult first language research has shown that the better a listener/reader is able to access a familiar schema, the better s/he will be able to comprehend, store in long term memory, and recall the discourse.[14] This research has taken two directions. First, this research has dealt with schematic or background knowledge about the formal, rhetorical structure of different kinds of texts, e.g., fables, simple stories, scientific research reports, and how such background knowledge of rhetorical structure aids comprehension and recall. The most extensively studied of these kinds of formal schemata has been the so-called story schema, and the formal rhetorical structure of stories has been described by what are called story grammars.[15] Most of this research has involved demonstrating that stories presented with a schema-theoretic or story grammar organization are understood and recalled much better than stories presented within non-schema-theoretic or scrambled organization.[16] Second,

this research has also dealt with schematic or background knowledge of the content of a text and how this kind of background knowledge affects comprehension and recall.[17] This research has shown that when subjects are provided with a schema or context against which to understand and recall a prose passage, they perform better than when they are not given such a schema and when the passage contains few or ambiguous clues as to the appropriate schema to be accessed.

This research on English as a first language has been conducted not only with fully proficient adults, but also with children at varying stages in the acquisition of English as their native language. The research with children has shown the role of schemata in the young child's early development of topic-relevant, non-egocentric social scripts.[18] Among school-age children schemata have been shown to play a significant role in story comprehension,[19] as well as in the development of reading comprehension skills.[20] In fact, one of the most fruitful applications of schema theory currently is to the study of reading comprehension in both children and adults.[21]

Cross-cultural Studies--First Language

The extent to which story schemata are culture-specific

has been a matter of some debate in the first language literature. One of the earliest cross-cultural reading studies was done by Sir Frederic Bartlett.[22] He asked educated Englishmen to read and recall the North American Indian folktale, The War of the Ghosts. Subjects were asked to recall the story more than once, in some cases over long periods of time--up to ten years. Bartlett found that subjects typically modified the tale in a manner consistent with their own culture. That is, in an effort to make the story meaningful, to understand it, they imposed their own European-based cultural schemata on it. Bartlett concluded that when people read a story, their background knowledge provides a framework for understanding the setting, mood, and chain of events.

In more recent research directed to the effect of rhetorical structure as a function of the cultural origin of the story, Kintsch argues that simple story schemata are culture-specific; that the simple structural story schemata described in the first language literature hold primarily for stories from European cultural background.[23] Story telling conventions in other cultures, he argues, may diverge greatly from these European-based schemata. In an empirical test of his hypothesis, Kintsch and Greene reported an experiment in which a group of American college students were asked to recall two stories: a Grimm's fairy tale and an

Apache Indian tale.[24] The experimenters were interested in finding out how the overall rhetorical structure of a text, due to its cultural origin, and the subject's familiarity with that structure, affected their comprehension. The Grimm's fairy tale was chosen because it presumably had a familiar rhetorical structure, while the Apache Indian story presumably had an unfamiliar one. Subjects listened to the stories and retold them, one to another, five times--yielding recall chains. Kintsch and Greene found that the Grimm's fairy tale was transmitted through the sequential retellings quite well, while the Apache Indian tale usually fell apart by the time it reached the last of the five retellings, if not before. They concluded that understanding a story and retelling it are facilitated when its organization is familiar. However, in their study, the content of the stories was also culture-specific.

Johnson & Mandler take the opposite position from Kintsch, arguing that at least some types of story formats appear to be universal.[25] In a recent study by Mandler, Scribner, Cole and DeForest few differences were found in memory for a set of European stories when the performance of American children and adults was compared with that of Vai subjects in Liberia on the same stories.[26] The stories were the same stories Mandler & Johnson had used with

American subjects,[27] except that they were translated into Vai, the Liberian's native language, and certain foreign concepts were translated into locally meaningful ones, e.g., dragons became water people, and princesses became chiefs' daughters. Mandler, et al. report that the Liberians found the stories to be perfectly acceptable as local tales, and that the patterns of recall among the Liberians were similar to that of the Americans.

Thus, the issue of the effect of form and framework on the cultural-specificity of story schemata when stories are processed in one's native language is not clearly resolved. And because these cross-cultural studies have not clearly separated formal story-structure schemata from content schemata, the effects of each are not clearly distinguished in these studies.

Second Language Research

Much less research has been done to date on the role of schemata or background knowledge in second language comprehension, and most of what has been done involves content schemata. To my knowledge, a study by Carrell in 1981 is the only second language study involving formal schemata.[28] In that study it was found that when stories violating the

story schema are processed by second language learners, both the quantity and the quality of recall were affected. In other words, when content is kept constant, but the rhetorical structure varied, second language comprehension is affected.

Steffensen, Joag-dev & Anderson,[29] Johnson,[30] and Carrell[31] have studied the effects of content schemata on the comprehension and recall of stories by different groups of non-native speakers of English--Asian Indian, Iranian, and Japanese and Chinese subjects, respectively, in the three studies--each non-native group compared to native speakers of English. They all found that each group of native and non-native English speakers read the material dealing with their own cultural background faster and recalled more of the culturally familiar text than of the culturally foreign text. Of course, the Americans read faster and recalled more, overall, a reflection of the fact that they were reading in English as their native language, while the other groups were reading in English as a second or foreign language. But each group did better on material for which they had appropriate cultural background schemata than on material for which they lacked appropriate cultural background schemata, when the texts were equal in linguistic complexity.

Conclusion

In this paper I've attempted to show the new insights that schema theory has yielded in language comprehension. Viewing language comprehension as the interaction between the text and its structure, on the one hand, and the background or schematic knowledge of the listener/reader, on the other hand, leads to a better understanding of the many facets of comprehension. Use of schema theory enables us to understand both first and second language comprehension, both adult and child language comprehension. Use of schema theory also enables us to address the most potent and far-reaching schemata of all, sociocultural schemata and their variation across cultures. Use of schema theory also enables us to address language comprehension problems; these problems may be due to linguistic deficiencies, deficiencies in background or schematic knowledge, including deficits in cultural knowledge, or to the interaction of deficits in linguistic and background knowledge.

More empirical research from a schema theoretic viewpoint is needed. This research must be carefully designed to sort out those effects due to the rhetorical, suprasentential organization of a text, i.e., formal schemata, from effects due to content, i.e., content schemata. We also need additional theoretical research on the nature of various kinds of texts.

Notes

[1]A version of this paper was presented orally at the 1981 Mid-America Linguistics Conference and apepars in the conference proceedings Proceedings of the Mid-America Linguistics Conference, 1981, Wichita State University, October 16-17, edited by Tina Bennett-Kastor and published in late 1981.

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[6]Deborah Tannen, "The Effect of Expectations on Conversation," Discourse Processes, 1 (1978), pp. 203-209.

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[8]Bartlett (note 2 above), p. 201.

[9]David E. Rumelhart & Andrew Ortony, "The Representation of Knowledge in Memory," Schooling and the Acquisition of Knowledge, ed. Richard C. Anderson, Rand J. Spiro, & William E. Montague (Hillsdale, NJ: Lawrence Erlbaum Associates, 1977), p. 100.

[10]Schank & Abelson (see note 3 above).

[11]David E. Rumelhart, "Understanding and Summarizing Brief Stories," Basic Processes in Reading: Perception and Comprehension, ed. David La Berge & S. Jay Samuels (Hillsdale, NJ: Lawrence Erlbaum Associates, 1977).

[12]Adams & Collins (see note 2 above)

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[15]Jean M. Mandler, "A Code in the Node: The Use of a Story Schema in Retrieval," Discourse Processes, 1 (1978), pp. 14-35; Mandler & Johnson (see note 14 above).

[16]Walter Kintsch, Theodore S. Mandel, & Ely Kozminsky, "Summarizing Scrambled Stories," Memory and Cognition, 5 (1977), pp. 547-552; Mandler (see note 15 above).

[17]Bransford & Johnson (see note 14 above, 1972 and 1973).

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[21]Adams & Collins (see note 2 above).

[22]Bartlett (see note 2 above).

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[24]Kintsch & Greene (see note 23 above).

[25]Nancy S. Johnson & Jean M. Mandler, "A Tale of Two Structures: Underlying and Surface Forms in Stories," CHIP Report #80 (San Diego: Center for Human Information Processing, 1979).

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[29]Margaret S. Steffensen, Chitra Joag-dev, & Richard C. Anderson, "A Cross-Cultural Perspective on Reading Comprehension," Reading Research Quarterly, 15 (1979), pp. 10-29.

[30]Patricia Johnson, "Effects on Reading Comprehension of Language Complexity and Cultural Background of a Text," TESOL Quarterly, 15 (1981), pp. 169-181.

[31]Patricia L. Carrell, "Culture-Specific Schemata in L2 Comprehension," Selected Papers from the Ninth Illinois TESOL/BE Annual Convention, First Midwest TESOL Conference, ed. Richard Orem & John Haskell (Chicago, IL: Illinois TESOL/BE, 1981).